Letters to the Editor

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Total to L-shell photoelectric cross section ratios

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Photoelectric effect behaves differently from those of other partial processes of interaction of photons with matter, in the sense the former is characterised with discontinuities in the cross section at the atomic shell binding energies, which is a result of the participation of new shells as the energy of the photon increases. Hence an estimation of relative contributions of shell effect to that of total or total to shell ratio can be made. There seems to be no measurements below K-edge on the total to L-shell photoelectric cross sections ratio (T/L) except in Uranium at 103 keV where L/M ratio is estimated (Sujkowski 1961). Hence it is of interest to have some data on these ratios. In this letter T/L ratios in Ta, Au and Pb at L_3 binding energies are reported.

Of the methods available (Hultberg 1959, Grigorev 1959, Hopkins 1959), deduction of the ratio from the total photon attenuation coefficients is the simplest. The photoelectric cross sections around L-edges can be obtained very accurately by measuring the total photon attenuation coefficients and by subtracting the coherent and incoherent scattering cross section contributions (Storm & Israel 1970) which are very small at these energies. Total cross section measurements at low energies are already reported by one of the authors (Parthasaradhi *et al* 1973) using Si(Li) and Ge(Li) detector systems at the required energies. However, to have sufficient number of data points for polynomial fittings, two more measurements are made in lead at 5.959 keV ($\overline{K}_{\alpha\beta}$ X-rays from ^{55}Fe) and 10.532 keV ($\overline{K}_{\alpha}$ X-rays from ^{75}Se) using Argon filled proportional counter on a good geometry set-up (Sivasankara Rao 1975), Radhakrishna Murty 1975). The logarithmic values of cross sections and energies are fitted to a polynomial by the method of least squares using IBM 1130 computer. The trends are extended upto the L_1 edge energy of each element and the T/L ratios are deduced in Ta, Au and Pb. A typical of such plots in Ta is shown in figure 1. The obtained ratios along with the least theoretical values of Scofield (1973) are given

in table 1. The errors in the estimation of T/L ratios (of the order 4%) are calculated by taking into account the errors in the cross section and the possible uncertainties in the polynomial fittings. An observation of table 1 shows that there is good agreement between theory and experiment.

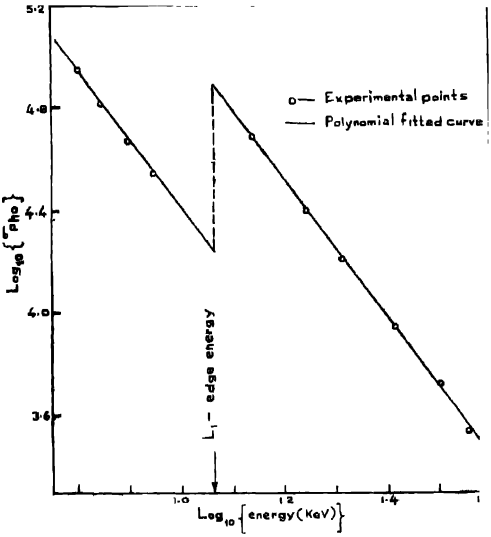

Fig. 1. Least square fitted curves using below and above Ledge photoelectric cross-section data for Ta.

Table 1. T/L ratios at L-shell binding energy

Element	Experimental	Theoretical
Tantalum	1.29±4%	1.31
Gold	1.33±4%	1.32
Lead	1.34±4%	1.33

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